

**SIJIL PENDIDIKAN MRSM
2015**

CHEMISTRY

Paper 2

MARKING SCHEME

FOR EXAMINER'S USE ONLY

The marking scheme consists of 13 printed pages

MARKING GUIDELINES
SIJIL PENDIDIKAN MRSM EXAMINATION 2015
PAPER 2

Symbol		Meaning
//	-	replace the whole sentence
()	-	replace the previous word
[]	-	can be summarized from explanation
___ or bold	-	key word
a.d.p	-	avoid double penalty
wcr	-	wrong cancel right
a.	-	accept
r.	-	reject
e.c.f	-	error carry forward
/	-	or

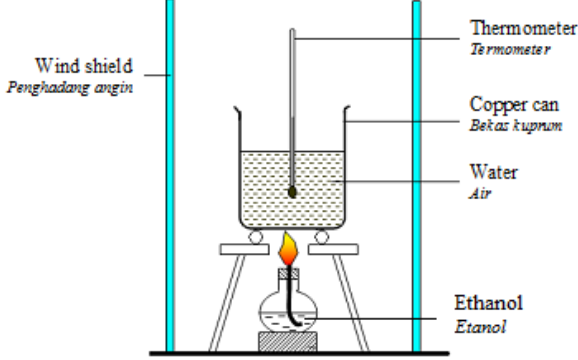
SECTION A

Question No 1	Mark Scheme	Sub Mark	ΣM
(a)	Answer : Analgesic	1	
	Sample answer: Paracetamol // Aspirin	1	2
(b)	Sample answer : 1. To kill/inhibit all bacteria // to slow down/retard the growth of bacteria	1	
	2. Bacteria can become resistant to the antibiotic // To avoid become ill again	1	2
(c)	Sample answer : Peria, Bitter gourd (<i>Momordica charantia</i>) // Daun hempedu bumi (<i>Andrographis paniculata</i>) // Daun misai kucing (<i>Orthosiphon aristatus</i>) // Kacang panjang // Akar petawali (a : any reasonable answer)	1	1
	(ii) Sample answer: Lower cost // Easily available // Biodegradable // Less side effect	1	1
(d)	Aspartame // Stevia // Honey // Maple syrup // Brown sugar	1	1
(e)	(i) Answer : Preservative	1	1
	(ii) Sample answer : Increase cancer risk / can cause colon cancer / leukemia / nose and throat cancer / can cause nausea / dizziness / carcinogenic	1	1
	TOTAL		9

Question No 2	Mark Scheme	Sub Mark	ΣM
(a)	Answer : Group 18 // Noble gases // Inert gases // Group VIII	1	1
(b)	Answer : Helium r : He	1	2
	<u>Explanation</u> Sample answer : Stable // not easily burnt // lighter // unreactive	1	
(c)	(i) Answer : 2.8.1 / 2,8,1 r: 2:8:1	1	6
	(ii) Answer : 1. Nuclei attraction towards valence electron / Force of attraction between nucleus/proton and valence electron in atom Z is <u>weaker</u> 2. Ability for <u>atom Z</u> to release/lose one/valence electron is easier	1 1	
	(iii) Answer : 1. Ionic compound (r : ionic bond) 2. ZY (r : YZ) (Accept actual symbol for Z/K and Y/Cl)	1 1	
	(iv) R, Q, Y, X, T, Z	1	
	TOTAL		9

Question No 3	Mark Scheme	Sub Mark	ΣM
(a)	(i) Answer: Alkene	1	2
	(ii) Answer: $ \begin{array}{ccccccc} & & \text{H} & & & \text{H} & \\ & & & & & & \\ \text{H} & - & \text{C} & - & \text{C} & = & \text{C} & - & \text{C} & - & \text{H} \\ & & & & & & & & & & \\ & & \text{H} & & \text{H} & & \text{H} & & \text{H} & & \end{array} $ a: CH ₃ CH=CHCH ₃	1	
(b)	Answer : $\text{C}_4\text{H}_8 + 6 \text{O}_2 \rightarrow 4 \text{CO}_2 + 4 \text{H}_2\text{O}$ 1. Correct formula of reactants and products 2. Balanced equation	1 1	2
(c)	Answer: Phosphoric acid // 300 °C // 60 atm	1	1
(d)	(i) Answer : Brown solution becomes colourless / decolourised	1	4
	(ii) Answer : 2,3-dibromobutane	1	
	(iii) Answer : 1. Bubble / pass through / flow the gas /compound P into bromine water in a test tube/suitable container // add bromine water into the test tube containing gas P 2. Shake	1 1	
(e)	Answer: Butyl ethanoate	1	1
	TOTAL		10

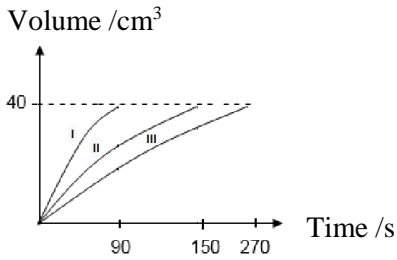
Question No 4	Mark Scheme	Sub Mark	ΣM
(a)	Answer : Acid V : hydrochloric acid // HCl Alkali T: sodium hydroxide // NaOH	1 1	2
(b)	(i) Answer : Neutralisation	1	2
	(ii) Answer : $\text{HCl} + \text{NaOH} \rightarrow \text{NaCl} + \text{H}_2\text{O}$ 1. Correct formula reactants and products	1	
(c)	Answer : 1. no. of mol of acid V = $\frac{0.1 \times 50}{1000}$ // 0.005 mol 2. From equation, 1 mol of acid V react with 1 mol alkali T 0.005 mol of acid V react with 0.005 mol alkali T 3. ∴ the concentration of alkali T = $\frac{0.005 \times 1000}{25}$ mol dm ⁻³ // = 0.2 mol dm ⁻³ (ecf : no. of mol of acid V for P2 only) OR 1. $\frac{M_a V_a}{M_b V_b} = \frac{1}{1}$ 0.1 x 50 = M _b x 25 2. M _b = 0.2 mol dm ⁻³ *(2 marks only for this method)	1 1 1	3
(d)	Answer : 1. Heat the solution until saturated and cool. 2. Filter and dry the crystal	1 1	2
(e)	Answer : Sodium ethanoate /Sodium acetate/ CH ₃ COONa / NaCH ₃ COO	1	1
	TOTAL		10

Question No 5	Mark Scheme	Sub Mark	ΣM
(a)	Answer: Heat released when 1 mole of lead(II) sulphate is formed	1	1
(b)	Sample answer : Exothermic reaction // The heat of precipitation for 1 mol of lead(II) sulphate is -50.4 kJ // The heat released when 1 mol of lead(II) sulphate formed is 50.4 kJ // // Total energy content of the reactants/lead(II) nitrate and sodium sulphate is higher than total energy content of the products/lead(II) sulphate and sodium nitrate // 1 mol of lead(II) nitrate react with 1 mol of sodium sulphate to produce 1 mol lead(II) sulphate and 1 mol sodium nitrate and released 50.4 kJ (Any one)	1	1
(c)	(i) Answer : Heat change = (50)(4.2)(14) J // 2940 J // 2.940 kJ	1	4
	(ii) Answer: 1. Number of moles of $\text{Cu}(\text{NO}_3)_2 = \frac{(0.5)(50)}{1000}$ // 0.025 mol 2. 0.025 mol of Cu release 2940 J ∴ 1 mol of Cu release $\frac{2940\text{J} \times 1}{0.025} = 117600 \text{ J}$ 3. Heat of displacement, $\Delta H = - 117.6 \text{ kJ mol}^{-1}$ (ecf : No of mole for P2)	1 1 1	
(d)	Answer: 1. Sulphuric acid is a diprotic acid while hydrochloric acid is a monoprotic acid // 1 mol of sulphuric acid produce 2 mol of H^+ ions while 1 mol of hydrochloric acid produce 1 mol of H^+ ions 2. Concentration of hydrogen ions in Experiment II/sulphuric acid is <u>doubled /twice/two times</u> 3. Number of mole of water formed is double/twice/two times	1 1 1	
(e)	Answer: 1. Functional diagram 2. Correct label 	1 1	2
	TOTAL		11

Question No 6	Mark Scheme		Sub Mark	Σ M
(a)		Answer : Electrical to chemical energy	1	1
(b)	(i)	Answer : Brown solid deposited r: electrode become thicker	1	3
	(ii)	Answer : $\text{Cu}^{2+} + 2\text{e} \rightarrow \text{Cu}$	1	
	(iii)	Answer: +2 to 0	1	
(c)		Answer : 1. Oxygen gas r : O ₂ 2. Insert/put/place the glowing wooden splinter into the test tube/boiling tube. 3. The glowing wooden splinter relights/rekindles/reignites *P1 must be correct in order to get P2 and P3	1 1 1	3
(d)		Answer: 1. Blue to light blue // intensity of the blue colour decreases 2. The concentration of Cu ²⁺ ions /the number of Cu ²⁺ ions per unit volume decreased	1 1	2
(e)		Answer: 1. Copper(II) ion // Cu ²⁺ 2. Copper atom release electrons /ionise/oxidise to form Cu ²⁺	1 1	2
		TOTAL		11

Scheme Answer

Question No 7	Mark Scheme	Sub Mark	ΣM	
(a)	Answer : 1. Diffusion (r : diffuse) 2. Potassium manganate(VII) consists of tiny and discrete particles/ions 3. The particles/ions move in between / diffuse between the space of agar / gel 4. from higher concentration to lower concentration adp : particles / ions	1 1 1 1	4	
(b)	(i)	Answer: 1. Correct symbol ; J / Li 2. Correct proton number and nucleon number ${}^7_3\text{J}$	1 1	2
	(ii)	Answer : 1. Atom J has 3 proton and 3 electrons 2. The number of positive charges is equal to the number of negative charges 3. Ion J^+ have 3 protons and 2 electrons // Atom J lose one electron to form ion J^+ 4. The number of positive charge is more than the number of negative charge by one unit	1 1 1 1	4
(c)	(i)	Answer: 1. Melting point and boiling point for MgO is higher than CO_2 2. The ions are held together by strong electrostatic force 3. More heat energy is needed to overcome the force. 4. Molecule CO_2 are held together by weak intermolecular force / Van der Waals force 5. Less heat energy needed to overcome the force	1 1 1 1 1	5
	(ii)	Answer: 1. MgO can conduct electricity in molten state or aqueous solution 2. but CO_2 cannot conduct electricity at any state. 3. MgO in solid cannot conduct electricity because ion held together/do not have free moving ion 4. MgO in molten and aqueous solution consists of ion that move freely/mobile 5. CO_2 consists of neutral molecule / Do not have ions	1 1 1 1 1	5
		TOTAL		20

Question No 8	Mark Scheme	Sub Mark	ΣM
(a)	Answer: 1. Smaller size has larger total surface area 2. Absorb more heat 3. Time taken to cook is shorter	1 1 1	3
(b) (i)	Answer: 1. Average rate of reaction experiment I = $40 / 90 = 0.44 \text{ cm}^3 \text{ s}^{-1}$ 2. Average rate of reaction experiment II = $40 / 150 = 0.27 \text{ cm}^3 \text{ s}^{-1}$	1 1	2
(b) (ii)	Answer :  1. Label the axis and unit 2. Correct position of the three curves and labeled 3. Volume marked at 40 cm^3 and time taken shown correctly for all experiments	1 1 1	3
(b) (iii)	Answer : $\text{Zn} + 2 \text{H}^+ \rightarrow \text{Zn}^{2+} + \text{H}_2$ 1. Correct formula of the reactants and products 2. Balanced equation	1 1	2
(b) (iv)	Answer : Experiment I and II 1. Rate of reaction of Experiment I is higher 2. Copper(II) sulphate solution acts as catalyst 3. provide an alternative path with lower activation energy 4. More colliding particles able to achieve the activation energy 5. The frequency of effective collision between zinc atom and hydrogen ions is higher *adp : higher Experiment II and III 1. Rate of reaction in experiment II is higher 2. The concentration of hydrochloric acid in experiment II is higher 3. The number of hydrogen ions per unit volume is higher 4. The <u>frequency</u> of collision between zinc atom and hydrogen ions is higher 5. The <u>frequency</u> of effective collision between particles is higher	1 1 1 1 1 1 1 1 1 1	10
	TOTAL		20

Question No 9	Mark Scheme	Sub Mark	ΣM																				
(a)	Answer: 1. Reinforced concrete is made up of <u>concrete</u> and steel/ steel bars/ steel wires / polymer fibres 2. Concrete is strong but brittle/ weak in tension 3. And steel is strong in tension 4. Combination of concrete and steel produced a tough and more tensile strength material	1 1 1 1	4																				
(b)	Answer : 1. SO ₂ causes respiratory problem in humans 2. Sulphur dioxide dissolves in rainwater to form acid rain. 3. Lakes and rivers become acidic 4. Fish and other aquatic organisms die 5. pH of the soil decreases 6. Salts are leached out of the top soil./ roots of trees are destroyed / plants die of malnutrition and diseases *P3,4,5 & 6 are given marks if P2 is mentioned.	1 1 1 1 1 1	6																				
(c)	Answer: Apparatus : 1 kg weight, ruler, retort stand and clamp , steel ball bearing , thread Materials : copper block, bronze block, // copper block, brass block , cellophane tape (a: If materials and apparatus are listed together) Procedure 1. Steel ball bearing is taped onto a copper block 2. A [1-2] kg weight is hung at a height of 50 cm above the steel ball bearing. 3. The weight is allowed to drop onto the steel ball bearing 4. The diameter of the dent made by the ball bearing on the copper block is measured. 5. Step 2-4 are repeated three times 6. The experiment is repeated using bronze block/ brass block Tabulation of data <table border="1" data-bbox="373 1496 1139 1653"> <thead> <tr> <th data-bbox="373 1496 587 1532">Metal block</th> <th colspan="4" data-bbox="587 1496 1139 1532">Diameter of dent (mm)</th> </tr> <tr> <td data-bbox="373 1532 587 1568"></td> <th data-bbox="587 1532 671 1568">1</th> <th data-bbox="671 1532 815 1568">2</th> <th data-bbox="815 1532 959 1568">3</th> <th data-bbox="959 1532 1139 1568">Average</th> </tr> </thead> <tbody> <tr> <td data-bbox="373 1568 587 1603">Copper</td> <td data-bbox="587 1568 671 1603"></td> <td data-bbox="671 1568 815 1603"></td> <td data-bbox="815 1568 959 1603"></td> <td data-bbox="959 1568 1139 1603"></td> </tr> <tr> <td data-bbox="373 1603 587 1639">Bronze /brass</td> <td data-bbox="587 1603 671 1639"></td> <td data-bbox="671 1603 815 1639"></td> <td data-bbox="815 1603 959 1639"></td> <td data-bbox="959 1603 1139 1639"></td> </tr> </tbody> </table> 1. Label heading for type of metal block(MV) 2. Label heading for diameter of the dent with unit (RV) (If values are given, must be consistent with observation) Observation The diameter of the dent on the bronze /alloy block is smaller than copper/pure metal block	Metal block	Diameter of dent (mm)					1	2	3	Average	Copper					Bronze /brass					1 1 1 1 1 1 1 1 1 1	11 Max 10
Metal block	Diameter of dent (mm)																						
	1	2	3	Average																			
Copper																							
Bronze /brass																							
	TOTAL		20																				

Question No 10	Mark Scheme	Sub Mark	ΣM
(a)	Answer: In reaction I, 1. Iron(II) ion acts as a reducing agent/reductant 2. Iron(II) ion releases electron to form iron(III) ion// Oxidation number of iron increase from +2 to +3// Iron(II) ion is oxidized to form iron(III) ion // Iron(II) ion reduced Br ₂ to bromide ion In reaction II, 3. Iron(II) ion acts as an oxidising agent/oxidant 4. Iron(II) ion receive electron to form iron atom // Oxidation number of iron decrease from +2 to 0// Iron(II) ion is reduced to form iron atom // Iron(II) ion oxidized zinc to zinc ion	1 1 1 1	4
(b)	Answer : 1. N, carbon, M <u>Experiment I</u> 2. M can reduce carbon dioxide to carbon// M can react with carbon dioxide 3. M is more reactive than carbon <u>Experiment II</u> 4. Carbon can reduce N oxide to N// carbon can react with N oxide 5. Carbon is more reactive than N 6. Metal M is magnesium/ aluminium (r: Zinc) 7. Metal N is copper	1 1 1 1 1 1 1 1	7 Max 6
(c)	Sample Answer: 1. Example of oxidising agent: bromine water/chlorine water/ acidified potassium manganate(VII) / acidified potassium dichromate(VI). <u>Procedure</u> 2. Clamp a U-tube to a retort stand. 3. Pour dilute sulphuric acid into the U-tube 4. Carefully add potassium iodide solution to one of the arms of the U-tube 5. Carefully add bromine water to the other arm of the U-tube. 6. Dip a carbon electrode in each of the solution. 7. Connect the electrodes to a galvanometer <u>Confirmatory test</u> 8. Using a clean glass tube or dropper, draw out 1 cm ³ of potassium iodide solution into a test tube. Add a few drops of starch solution into the test tube. <u>Observations</u> 9. At potassium iodide/negative terminal brown solution	1 1 1 1 1 1 1 1 1	

		is formed that change starch solution to blue black 10. Bromine water change from brown to colorless // chlorine water change from pale yellow to colourless // acidified potassium manganate(VII) change from purple to colourless //acidified potassium dichromate(VI) change from orange to green 11. Deflection of needle of galvanometer	1 1	11 Max 10
		TOTAL		20

END OF MARKING SCHEME